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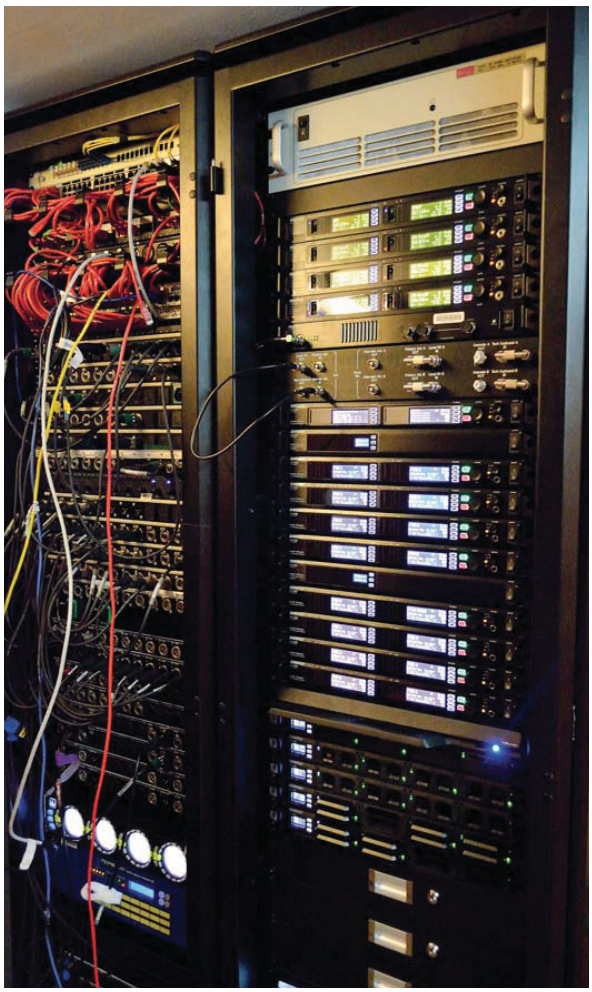


Racked Axient receivers within the Opera House

# The Spectrum

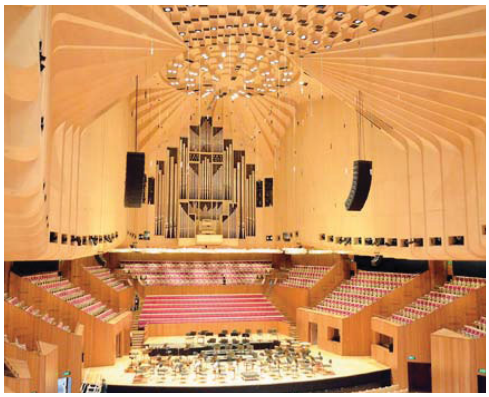
Australia's 4G digital dividend recently led the Sydney Opera House to upgrade its wireless microphone and IEM systems, writes **Richard Lawn**

**SYMBOLISING MODERN AUSTRALIA, THE SYDNEY OPERA** House (SOH) is not only the nation's premier cultural institution, it is officially the world's busiest performing arts centre. The World Heritage site attracted 8.2 million visitors in 2013, greeting them with world-class facilities that are continually upgraded and improved. Most recently, Australia's move towards 4G mobile coverage necessitated one such upgrade.

As soon as the fireworks lit up the sky above the Sydney Harbour Bridge to mark New Year's Day 2015, a significant part of the UHF spectrum was switched over to mobile voice and data applications and all Australian wireless users were forced by law from the familiar 520MHz to 820MHz band into the narrower confines of 520MHz to 694MHz. The digital dividend meant the existing wireless systems within SOH were redundant, but the changeover ultimately led to greatly enhanced compatibility and operability.

In his role as head of the Sound/AV Services department, Jeremy Christian strategically plans A/V infrastructure upgrades to ensure the Opera House satisfies the technical requirements of its current and future clients. 'From the outset of this project I wanted to integrate a system that could provide the RF requirements for everyday use of radio mic and IEM channels in each theatre,' Mr Christian explains. 'Installing infrastructure such as antennas, cabling, digital audio I/O and networking to service the RF systems would result in each theatre requiring a turnkey solution that would work for roughly 80 per cent of the current productions in those spaces. For the final 20 per cent I wanted to integrate expandable mobile systems that could boost the numbers of RF channels in any theatre, but with minimal setup and configuration. If we got to the end of the project and I saw antennas jacked up on top of mic stands I would see that as a failure! So my rationale was to have the mobile systems and roll them into any theatre with service ports allowing them to operate with the installed system.'

Having established Auditoria as a consultancy in 2003, Scott Willsallen's stature has grown internationally. Known for his fair-minded and open approach, he has been called upon to spearhead exacting audio fulfilments at all the Olympic Games and Asian Games over the past 12 years in addition to system upgrades such as the Sydney ANZ Stadium and Hillsong Church. SOH appointed him to project manage the wireless microphone dilemma facing the establishment in 2014. 'It was the first time I had been called upon by the Opera House to consult for them, which was naturally very gratifying being an Australian,' Mr Willsallen confirmed.



**Approximately 100 Axient channels have been supplied across the SOH venues**

The Opera House is made up of several venues including the Concert Hall, Joan Sutherland Theatre (JST), Studio, Playhouse, Drama Theatre and the Utzon Room. Mr Christian explains why the changeover provided them with a perfect opportunity to perform a system upgrade. 'Although the project was born out of a need to comply with the new requirements set out in the digital dividend, it quickly expanded to not just wanting to replace old for new but properly planning for and working out our requirements now and in the future. Previously, radio microphone infrastructures were installed over the years without proper planning, and as a result we had permanent infrastructure that in essence was multiple layers of temporary infrastructure. We also possessed multiple brands of radio mics and IEM, making RF plotting more complex than it needed to be. As such, we decided to take a clean slate approach to this project with the idea of installing the most optimised system for each theatre.'

In partnership with his colleague Steve Caldwell, Mr Willsallen's first task was to produce a stakeholders' document, ensuring extensive questionnaires and end-user input had to be fed into a performance brief. 'Auditoria were bought on board as consultants to scope and design this project and they were fantastic,' furthers Mr Christian. 'The experience they bought into this project is on display throughout the Opera House.' Despite creating a mass of paperwork, the exercise enabled Auditoria to gain a valuable insight into how the Opera House was currently operating. 'I interviewed the entire audio team and their feedback was paramount in selecting the right wireless systems with regards features, functions and performance,' recalls Mr Willsallen.

The combined wish list was then turned around into a reverse brief, in which the technical staff was presented with a detailed questionnaire comprising of some 60 questions regarding likes, dislikes and other functionality. The weighted score sheet was merit based so as not to provoke the respondents with any brand preferences or knee-jerk reactions. 'There was a budget for the project, so we couldn't simply throw money at it,' continues Mr Willsallen. 'We had to justify the numbers, in so far as we couldn't specify wireless channels in some of the lesser used venues if they were only going to be used several times a year. In such an instance, it wouldn't be a smart investment and as such it would be more cost effective to hire inventory. Luckily, I'm a detail freak, so I can make these assessments with the

# Solution

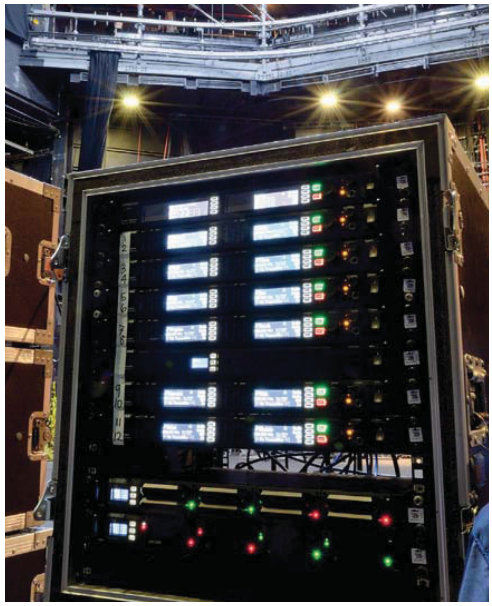
right information to hand.'

SOH released a tender advertisement via The Australian newspaper inviting suppliers to bid for the wireless microphone inventory changeover in mid-November 2014. Ultimately, a Shure Axient and PSM1000 wireless system was approved for the project following thorough market analysis provided by Mr Willsallen. Jands supplied approximately 100 channels to the many venues, with approximately half of this inventory being dedicated to mobile racks. It now measures as the second largest Axient installation in the world to date. In addition, Jands also conducted extensive training and certification for the technical staff at the Opera House. 'Jands provided a fantastic training programme,' explains Mr Christian. 'Jeff Mackenzie has trained over 35 people here at the Opera House on the workings of the Axient system since we took it on board.'

'The requirements were very specific and they were very clear as to what type of businesses they were trying to appeal to with the upgrade,' continues Mr Willsallen. 'I've worked with Axient at many high profile sporting events since its launch in 2012 and

**A Shure antenna covers the auditorium**

*'From pre-show planning to live performance monitoring throughout the network, full control of the Axient wireless system is enabled courtesy of Shure Wireless Workbench 6 software'*



**The mobile racks boast 36 radio microphone channels and 24 stereo IEMs**

I've been exposed to its capabilities. The asset management feature is critical and you can log into the scanner and operate the AXT600 Spectrum Manager remotely from anywhere.' For the Opera House technicians, time management has been addressed as the need to physically walk from one venue to another has been negated. 'Networked scanning and integration of the Shure AXT600 in each theatre means we can monitor house-wide RF activity in real time from any computer on the network,' adds Mr Christian.

The single rack-mounted AXT600 Axient Spectrum Manager provides the Opera House with wide-band UHF spectrum scanning, spectrum analysis and compatible frequency coordination. By scanning and displaying the RF environment, calculating compatible frequencies and deploying them to Axient receivers easily and efficiently, this interface allocates the best available frequencies to any number of wireless channels from the information it receives. Constructed of thick concrete, the Opera House is almost impenetrable to external RF sources from shipping except at its most northerly point where the Utzon Room's extensive glazing offering dazzling views of the Harbour but creates an Achilles' heel. 'The technicians can troubleshoot interference from shipping in such a complex RF environment,' explains Mr Willsallen. 'The AXT600 monitors and ranks a live list of backup frequencies, which can then be used instantly and automatically when an Axient Receiver detects interference.'

From pre-show planning to live performance monitoring throughout the network, full control of the Axient wireless system is enabled courtesy of Shure Wireless Workbench 6 software. Prior to a performance, Wireless Workbench 6 utilises saved scan files to provide detail about the RF environment from off-site, including a database of TV channels based on location. When connected to the Axient Spectrum Manager, Wireless Workbench performs live RF scans and analysis, with graphic overlays and device markers on a frequency plot. Frequency coordination uses the scan data, TV channel database and advanced compatibility algorithms to create and assign a list of clean, viable frequencies for any number of channels in a system, together with backup frequency management. During a performance itself, Wireless Workbench 6 enables live remote adjustments to networked hardware for instant changes to frequency, gain and RF output power. Channel strip interfaces have been customised to depict audio and RF meters, battery life and volume control for each channel. Configurable user alerts offer a quick response via the software to troubleshoot detected interference issues or for battery life and RF signal strength conditions.

Once selected, the more laborious task of creating an infrastructure document was undertaken. 'The Opera House venues contain complex Ethernet and cabling infrastructures with wireless antennas,' continues Mr Willsallen. 'It was an ideal time to rationalise all of this. The equipment racks to the sides of the stage all needed to be replaced allowing easier access for the crews when setting up and dismantling.' The PA People, a well-known installer and supplier, is no stranger to either its ex-employee, Mr Willsallen, or the Opera House itself, so the company was delighted to be reunited with both following its successful tender application, and to make use of its detailed knowledge of the Opera House, earned during previous projects. 'The optimal antenna placement in some of the larger theatres required some very long cable runs,' furthers Mr Christian. 'In order to overcome the loss of signal over Coax cable, RF over fibre transmission was required to keep the RF attenuation to a minimum.'

The largest venue in terms of wireless count is the Concert Hall, which is now equipped with 16 Axient channels and eight stereo PSM1000 IEMs. The JST boasts half this number, whilst the Playhouse, Studio and Drama Theatres each utilise six channels of wireless whilst the Utzon Room being the smallest requires only two. The portable mobile racks combine 36 radio microphone channels with 24 stereo IEMs.

The expertise drafted in from Auditoria, The PA People and Jands has been combined to successfully negotiate the tricky digital dividend watershed whilst future-proofing the wireless systems of the Sydney Opera House for many years to come. 'The result for me is that we have a world-class, integrated radio microphone and IEM system that provides the Opera House with the best possible RF infrastructure to deal with any RF challenges,' attests Mr Christian. 'It is a system that is scalable in each venue so we can build up from a baseline system to a very large system should the need arise. Thanks to the training we have received, Axient is easy to configure and provides us with a greater amount of flexibility.'

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